

REMARKS

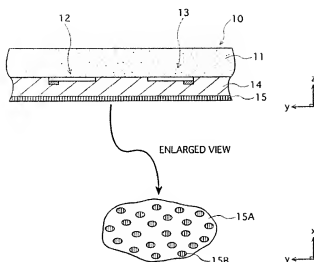
This Supplemental Amendment replaces the Amendment of July 20, 2007 and corrects minor typographical errors in the claims and removes a reference to Page 19, lines 24-26 which was directed to forming etched electrodes in the Remarks.

Claims 1, 3-7, and 29-55 remain in the application. Claims 39-55 are newly added, but do not add any new matter.

The present invention relates from the discovery that by utilizing a protective layer formed from a first crystal material and a second crystal material spread through the first crystal material at the surface of the protective layer, the firing voltage V_f and black noise due to discharge variability can be reduced in a plasma display panel (PDP).

The present invention utilizes, for example, MgO crystal 15A and fine MgO crystalline particles 15B. The fine MgO crystalline particles 15B are dispersed throughout the MgO crystal 15A. An MgO precursor of organic material is baked to form MgO crystal 15A. Fine MgO crystalline particles 15B, on the other hand, are crystallized prior to the precursor being baked, and have a crystal structure of higher purity than MgO crystal 15A. (Pg. 13, Ins. 20 – 27; Figs. 1, 3). This can be seen in Figure 3 below:

FIG. 3



To reduce the firing voltage, the discharge gas is excited by an electric field generated in discharge space 24 when the PDP is driven, which causes Ne^+ in the discharge gas to approach the surface of the protective layer. This initiates an Auger process in which electrons in the valance band of the protective layer migrate to the outer shell of the Ne. Following this migration of the electrons, other electrons in the protective layer receive the change in energy of the electrons that have migrated to Ne^+ and are ejected into discharge space 24 by potential emission. This results in very good secondary electron emission properties, which allows for a reducing in the firing Voltage Vf. (Pg. 14, lns. 4-23; Figs. 1, 3)

To reduce the discharge variability and prevent black noise, electrons in fine MgO crystalline particles migrate to oxygen deficient regions when vacuum ultraviolet from the electric field generated in discharge space 24 when PDP is driven. The oxygen deficient regions then act as the luminescence center due to the energy difference between electrons in these regions and emit visible light. Following the visible light emission, electrons in fine MgO

crystalline particles 15B are excited from the valence band E_v to an energy level in a vicinity of the conduction band E_c . The carrier density of protective layer 15 improves with the increase in electrons having impurity level E_3 , allowing for impedance control. Thus, black noise can be prevented in addition to controlling discharge variability. (Pg. 15, lns. 9 – 28; Fig. 5).

The Office Action rejected Claims 1, 3-6, 19, 21, 23, 24, 29-38 under 35 U.S.C. § 102(b) as being anticipated by *Takatani et al.* (JP 9-208851).

Takatani is directed towards forming a thinner dielectric protective coat which is resistant to exfoliation, small external forces, and being converted to gel, but allows high breakdown voltage and discharge sustaining voltage. (Tech. Prob. ¶¶ 0006-10) It accomplishes this by adding an additive which consists of organic substances and MgO particles to the MgO precursor and baking the organic substance, the MgO particles, and the MgO precursor to produce an MgO binder. (Detailed Descrip. ¶ 0011).

Takatani does not teach or suggest “a protective layer formed on the first substrate, including a first crystal and a second crystal, the first crystal having different electron emission properties than the second crystal, wherein at the surface of the protective layer the second crystal is dispersed throughout the first crystal and the second crystal and the first crystal are exposed to the discharge space.” *Takatani* only discloses crystal growth in the MgO binder by using the MgO particle as seed crystal. (Detailed Descrip. ¶ 0020). However, there is no indication that the other two materials form crystals or that they form two different crystals with different electron emission properties.

In contrast, in the present invention, fine MgO crystalline particles 15B are dispersed throughout the MgO crystal 15A. The MgO crystal has only moderate electron emission properties. (Pg. 14, ln. 15 – 20). On the other hand, the fine MgO crystalline particles 15B have

excellent electron emission properties. (Pg. 15, lns. 9 – 12). In one embodiment, the MgO crystal 15A is beneficial because it is used in thick film techniques which are the low cost manufacturing of protective layers with excellent throughput. (Pg. 14, lns. 12 – 23). The addition of MgO 15B crystalline particles helps control the discharge variability and prevent black noise. (Pg. 15, lns. 9 – 28). Furthermore, the combination of both the MgO crystal 15A and the MgO 15B crystalline has very good secondary electron emission properties, which allows for a reduction in the firing voltage V_f . (Pg. 14, lns. 12 – 14).

In addition, *Kim et al.* (U.S. 6,379,783) does not disclose “a protective layer formed on the first substrate, including a first crystal and a second crystal, the first crystal having different electron emission properties than the second crystal, wherein at the surface of the protective layer the second crystal is dispersed throughout the first crystal and the second crystal and the first crystal are exposed to the discharge space.”

Kim et al. is directed towards a method of forming an MgO protection layer of plasma display panel through direct coating MgO solution on the surface of the dielectric layer. The MgO solution can be MgO particles, salt containing Mg, and organic binder mixed together. (Abstract)

Kim et al. only discloses that “After firing, MgO particles are created from the salt and adhere to the existing MgO particles that function as a seed to start the growth of MgO” (Col. 4, lns. 50-52). There is no indication in *Kim et al.* that two crystals with two different electron emission properties are used.

For Claim 3, *Takatani* does not teach or suggest “wherein the second crystal is of higher purity than the first crystal.” The Office Action cited to Paragraphs 20 and 22 of *Takatani*. However, *Takatani* only discloses that the MgO particle and the organic acid Mg can both be

99.95% or more pure. It does not disclose that one should be more pure than the other. In addition, only the MgO particle is disclosed to be a crystal. Thus, there is also no teaching of which one is the first crystal and which one is the second crystal.

In contrast, in the present invention, the second crystal can have a higher purity than the first crystal. The very pure crystal structure of the crystalline particles 15B results in excellent electron emission properties which aids in suppressing discharge variability. (Pg. 15, lns. 9 – 12) The second crystal is also dispersed throughout the first crystal at the surface of the protective layer.

Takatani also fails to recite “wherein the protective layer is formed mainly from MgO, and the second crystal is formed from fine MgO crystalline particles” in Claim 4. *Takatani* only discloses the use of MgO particles, MgO precursor, MgO binder, and organic paste. There is no indication that *Takatani* uses fine MgO crystalline particles.

With respect to Claim 29, *Takatani* does not teach or suggest “the first crystal has a growth structure characteristic of at least a vacuum deposition, an electron beam deposition or a sputtering process.” Through vacuum deposition, electron beam deposition or sputtering, the crystal has a columnar structure, which is different than the structure of a film formed by a thick film technique. There is no teaching in *Takatani* that the crystals have a columnar structure or that they are formed through vacuum deposition, electron beam deposition, or sputtering.

In contrast, in the present invention, the first crystal can be formed through vacuum deposition, electron beam deposition, or sputtering. (Pg. 21, lns. 4-8; Pg. 3, lns 5-7). If the crystal is formed through vacuum deposition, the crystal has a columnar structure. See *Kajiyama et al.* (U.S. Patent App. No. 2002/0047816) (¶¶ 0033, 0034, 0044, 0059, 0067, 0073); *Kotera et al.* (U.S. Patent App. No. 2004/0056594) (¶¶ 0059, 0064); *Kim* (U.S. Patent App. No.

2005/0082982) (Claim 1). If the crystal is formed through electron beam deposition or sputtering, the crystal also has a columnar structure. See *Kotera* (¶¶ 0059, 0064, 0115); *Iwase* (U.S. Patent App. No. 2006/0192488) (¶¶ 0005, 0040). The *Kajiyama*, *Kotera*, *Kim*, and *Iwase* reference are cited to show the common knowledge in the field of thin films and columnar structures.

With respect to Claim 30, *Takatani* does not disclose wherein the “the first crystal has a growth structure characteristic of a thin film technique.” There is no indication in *Takatani* that the first crystal is formed through a thin film technique. *Takatani* only discloses using the MgO particle as see crystal. (Detailed Descrip. ¶ 0020).

In contrast the present invention can be formed using thin film techniques. This thin film technique can include for example, vacuum deposition, electron beam deposition, or sputtering. (Pg. 3, lns. 5 – 7; Pg. 21, lns. 4-8); see *Kotera* (¶¶ 0115-0116).

With respect to Claims 31-32, all arguments for patentability with respect to Claim 30 are repeated and incorporated herein.

All arguments for patentability with respect to Claim 1 are repeated and incorporated for Claim 39.


Furthermore, Claims 41-42 are patentable for at least the reasons given in Claims 29-32.

Dependent Claims 3-7, 29-38, 40, 43-52, and 55 depend from and further define independent Claims 1, 39, 41, 42, and 53 and are allowable, too.

If the Examiner has any questions with regards to the prosecution of this case, the undersigned attorney can be contacted at the listed phone number.

Very truly yours,

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